Amendments to the Drawings:

The attached replacement drawing sheets makes changes to Fig. 3 and replaces the original sheet with Fig. 3.

Attachment: Replacement Sheet

REMARKS

Claims 1-6 are pending in this application. By this Amendment, the specification and claims 1, 3 and 4 are amended. Further, drawing Fig. 3 is replaced with the attached Replacement Drawing Sheet No new matter is added. Reconsideration of the application is respectfully requested.

I. Information Disclosure Statement

The Office Action includes a copy of the Form PTO-1449 filed March 23, 2004 initialed to acknowledge the fact that the Examiner has considered some of the disclosed information. However, the Office Action indicates that JP-A-4-501517 (ref. 5), JP-A-2002-505910 (ref. 6) and WO 02/080828 A1 (ref. 11) have not been considered. Specifically, the initialed Form PTO-1449 indicates that the references do not include English-language translations.

Applicants enclose a PTO date-stamped receipt acknowledging that an English-language translation of JP-A-2002-505910 (ref. 6) has been received by the Patent Office. However, a copy of this English-language translation is attached for the Examiner's convenience.

As indicated in the March 23, 2004 Information Disclosure Statement, JP-A-4-501517 (ref. 5) corresponds to U.S. Patent No. 5,935,155 (ref. 1).

Regarding WO 02/080828 A1 (ref. 11), the Abstract of this reference is in English. Therefore, Applicants respectfully submit that an English-language translation of this reference is not required.

Therefore, the Examiner is requested to initial and return to the undersigned a copy of the Form PTO-1449 indicating that JP-A-4-501517 (ref. 5), JP-A-2002-505910 (ref. 6) and WO 02/080828 A1 (ref. 11) have been received and considered.

II. Specification Objections

The Office Action objects to the specification because of informalities. Specifically, the Office Action objects to various informalities on page 1 of the specification. The specification is amended to obviate the objections.

The Office Action also asserts that the length of the Abstract exceeds the 150 word limit. The Abstract is amended to obviate the objection. Accordingly, reconsideration and withdrawal of the objections are respectfully requested.

III. Drawing Objection

The Office Action objects to the drawings because of informalities. Specifically, the Office Action asserts that Drawing Fig. 3 includes elements 12, 13a, 13b and 26 that are not labeled in the block diagram. Fig. 3 is replaced with the attached Replacement Drawing Sheet to include labels for a photographing unit 12, an external unit 13, a converting unit 13a, a battery 13b, and an internal unit 26. Accordingly, withdrawal of the objection is respectfully requested.

IV. Rejection Under 35 U.S.C. §112, Second Paragraph

The Office Action rejects claims 3 and 4 under 35 U.S.C. §112, second paragraph, as indefinite. Specifically, the Office Action asserts that it is unclear whether the device of claims 3 and 4 are completely terminating or terminating for a brief period of time. Applicants respectfully traverse the rejection.

Claims 3 and 4 are amended only to correct informalities and to clarify that the complete termination of the switching of electrodes occurs within a specified period of time. Accordingly, reconsideration and withdrawal of the rejection is respectfully requested.

V. Rejections Under 35 U.S.C. §§102(b) and 103(a)

The Office Action rejects claims 1, 2 and 5 under 35 U.S.C. §102(b) over U.S. Patent No. 5,935,155 to Humayun t al. (Humayun); and rejects claims 3, 4 and 6 under 35 U.S.C. §103(a) over Humayun. Applicants respectfully traverse the rejections.

Humayun does not disclose, teach or suggest a visual restoration aiding device in which "the control unit simultaneously outputting the electrical stimulation pulse signals through the first electrodes for recognizing the object of one frame so as not to simultaneously output electrical stimulation pulse signals through the second electrodes arranged within a distance that the electrical stimulation pulse signals outputted through the first electrodes will interfere with each other, the control unit switching between the first electrodes to be used for outputting the electrical stimulation pulse signals and the second electrodes to be unused for outputting the electrical stimulation pulse signals with a lapse of time, and the control unit completely terminating the outputting of the electrical stimulation signals through all of the first electrodes necessary for recognizing the object of one frame, the outputting occurring within a duration needed for allowing the patient to recognize the object of one frame," as recited in independent claim 1.

The Office Action asserts that Humayun teaches a visual prosthesis including a controlling unit that inherently switches between electrodes being used and unused. Notwithstanding this assertion, Humayun does not teach or suggest a control unit simultaneously outputting electrical stimulation pulse signals through first electrodes and not simultaneously outputting electrical stimulation pulse signals through second electrodes arranged at a certain distance of the first electrodes to avoid interference, switching between the first electrodes used for outputting and the second electrodes unused for outputting within a lapse of time, and completely terminating the outputting of the electrical stimulation signals through all of the first electrodes necessary for recognizing the object of one frame.

Humayun teaches a visual prosthetic device including a retinal prosthesis 10 arranged to wirelessly transmit an image signal of an object photographed by an externally provided camera 12 to communicate with a circuit 20 placed in an eye. See Figs. 1 and 4, Abstract, and col. 5, line 66 – col. 6, line 9. Humayun also teaches that the retinal prosthesis 10 outputs stimulation signals from a plurality of electrodes (stimulation sites) arranged in an electrode array 22 to stimulate a retina of the eye. See Figs. 1 and 4, and col. 6, lines 9-12 and lines 45-56. Although Humayun teaches that the plurality of electrodes may be selected individually to output the stimulation signal, Humayun only suggests that the stimulation signals may simultaneously be outputted from the plurality of electrodes in a case where there are a large number of electrodes. See col. 7, lines 50-54.

Applicants note that Humayun's visual prosthetic device has problems associated with interfering signals. See page 1, lines 10-19. When electrical stimulation pulse signals are simultaneously outputted through adjacent electrodes, the signals are likely to interfere with one another to hinder visual restoration. See page 1, lines 20-24.

In the device of claim 1, a control unit controls the switching of electrodes so stimulation signals may be simultaneously output from a plurality of certain electrodes to shorten a time needed for full stimulation that allows a patient to recognize an object of one frame. For example, in Figs. 5A-5D, an internal unit 26 outputs electrical stimulation pulse signals simultaneously through unadjacent electrodes B1, B3, D1 and D3. See page 7, line 22 - page 8, line 5. Subsequently, the set of unadjacent outputting electrodes are switched for outputting electrical stimulation pulse signals. See page 8, lines 6-26. However, the outputting if electrodes is to be completed within a duration of time in which a patient can recognize one object. See page 8, line 27 - page 9, line 12.

As a result, interference of signals simultaneously outputted from the electrodes may be reduced. Also, visual restoration may be properly performed by electrodes arranged in

large number and at a high density while preventing interference of electrical stimulation pulse signals to improve resolution. See page 1, line 27 - page 2, line 3. Humayun does not teach or suggest such features or provide such advantages.

For at least the reasons discussed above, claim 1 is patentable over Huyamun. Claims 2-6 depend form claim 1, and thus also are patentable over Humayun for at least the reasons set forth above, as well as for the additional features they recite. Accordingly, reconsideration and withdrawal of the rejection is respectfully requested.

VI. Conclusion

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of claims 1-6 are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,

James A. Oliff
Registration No. 27,075

Holly N. Moore
Registration No. 50,212

JAO:HNM/axl

Attachments:
Petition for Extension of Time
Replacement Sheet (Fig. 3)
PTO Date-Stamped Receipt
English-language Translation of JP-A-2002-505910

Date: February 13, 2006

OLIFF & BERRIDGE, PLC
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Telephone: (703) 836-6400

DEPOSIT ACCOUNT USE AUTHORIZATION
Please grant any extension necessary for entry;
Charge any fee due to our Deposit Account No. 15-0461

PTO RECEIPT FOR FILING OF PAPERS

The following papers have been filed:

appln t, Ck 152425, $770, 13 pp spec/6 claims/abst, 6 pp draw (Figs 1-6), [illegible]ssign T Ltr, Ck 152424, $40, ASSIGN, IDS, PTO-1449, 10 ref's w. 5 abst & tran, cert copy JP 2003-093084 (3/31/03)

Name of Applicant: Toru YAGI, Hiroyuki TASHIRO, Yasuo TERASAWA

Serial No.: New U.S. Patent Application

Atty. File No.: 119202

Title (New Cases): VISUAL RESTORATION AIDING DEVICE

Sender's Initials: JAO/tmw

NEW APPLICATION

PATENT OFFICE DATE STAMP

COPY TO BE STAMPED BY PATENT OFFICE AND RETURNED BY MESSENGER

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] A means to be a means for perceiving a vision image, to answer this vision image, and to generate a visual signal output Retina tissue stimulus means applied to being attached in a user's retina on actuation Wireless visual signal means of communications for transmitting said visual signal output to said retina tissue stimulus means Artificial eye which it has.
[Claim 2] A means to perceive said vision image Camera means for changing a vision image into an electric impulse Image sampling means for connecting with said camera means and choosing an image at the predetermined time Encoder means for connecting with said image sampling means, encoding said selected image, and enabling the pixel-ized display of said image Artificial eye according to claim 1 which it has.
[Claim 3] Said retina tissue stimulus means The decoder means for answering said visual signal output and decrypting said visual signal output to two or more stimulus control signals of each, The current generating circuit means for answering said two or more stimulus control signals of each, and generating a stimulus current signal, while connecting with said decode means, Said electrode array in which it is an electrode array equipped with two or more electrodes connected with said current generating circuit means on actuation, and said electrode generates sufficient stimulus pulse to answer said each stimulus control signal and stimulate retina tissue Artificial eye according to claim 1 which it has.
[Claim 4] Said electrode array is an artificial eye [equipped with the attachment means for attaching said electrode array in said user's retina further] according to claim 3.
[Claim 5] It is the artificial eye according to claim 4 which said attachment means equips with at least one retina stop rivet located in said at least one mounting hole while said electrode array demarcates at least one mounting hole in it.
[Claim 6] Said attachment means is an artificial eye [equipped with the retina stop rivet of the part of said scallop form respectively located inside] according to claim 4, including the outside-surface edge to which said electrode array demarcates the part of at least two scallop forms to inside.
[Claim 7] Said attachment means is an artificial eye [equipped with the 2nd magnet suitable for being attached in the outside of the sclera of the user who counters the desirable point of attachment of said electrode array on said retina] according to claim 4, including 1st at least one magnet with which said electrode array was attached in it.
[Claim 8] Said attachment means is an artificial eye containing the adhesives arranged on the front face of said electrode array which should be attached in said retina according to claim 4.
[Claim 9] Said wireless visual signal means of communications The carrier generator means for generating a radio frequency carrier signal, Said modulator means to be a modulator means for answering said radio frequency carrier signal and said visual signal output, and modulating said radio frequency carrier signal with said visual signal output, and to generate a radio frequency modulation picture signal, It has the primary secondary coil. Said primary coil The tuning coil pair which aligns so that said secondary coil may receive said term radio frequency modulation picture signal while connecting with said modulator means on actuation and transmitting said radio frequency modulation picture signal, Demodulator means for connecting with said secondary coil and extracting said visual signal output from said radio frequency carrier signal Artificial eye according to claim 1 which it has.

[Claim 10] Furthermore, the artificial eye according to claim 9 which is connected with said secondary coil and equips said retina tissue stimulus means and said demodulator means with the power-source means for supplying power by extracting energy from said radio frequency modulation picture signal.
[Claim 11] Said power-source means is an artificial eye according to claim 10 which rectifies said radio frequency carrier signal from said radio frequency modulation picture signal received with said secondary coil, generates a direct-current power output, and provides said retina tissue stimulus means and said demodulator means with power.
[Claim 12] It is the medical equipment for recovering partially at least the vision of the user troubled with the degradation condition of photoreceptor. The camera means for changing a vision image into an electric impulse, Image sampling means for connecting with said camera means and choosing an image at the given time As if it connects with said image sampling means, said selected image is encoding-ized and a pixel-ized display is enabled, both An encoder means to output a visual signal output The carrier generator means for generating a radio frequency carrier signal, Said modulator means to be a modulator means for said radio frequency carrier signal and said visual signal output answering, and modulating said radio frequency carrier signal with said visual signal output, and to generate a radio frequency modulation picture signal, It has the primary secondary coil. Said primary coil The tuning coil pair which aligns so that said secondary coil may receive said term radio frequency modulation picture signal while connecting with said modulator means on actuation and transmitting said radio frequency modulation picture signal, The demodulator means for connecting with said secondary coil and extracting said visual signal output from said radio frequency carrier signal, The decoder means for connecting with said demodulator means, and answering said visual signal output, and decrypting said visual signal output to two or more stimulus control signals of each, Connect with said decoder means and said two or more stimulus control signals of each are answered. Current generating circuit means for generating a stimulus current signal It has two or more electrodes connected with said current generating circuit means on actuation. Electrode array which generates sufficient stimulus pulse for said electrode to answer said each stimulus control signal, stimulate retina tissue, and generate the phosphene Medical equipment which it has.
[Claim 13] Furthermore, medical equipment according to claim 12 equipped with said demodulator means, said decoder means, and the power-source means for supplying power to said current generating circuit means by connecting with said secondary coil and extracting energy from said radio frequency modulation picture signal.
[Claim 14] Medical equipment according to claim 13 with which said electrode array suits the eye implantation graft.
[Claim 15] Medical equipment according to claim 14 with which said secondary coil suits the eye implantation graft.
[Claim 16] Said demodulator means, said decoder means, said current generating circuit means, and said power-source means are medical equipment according to claim 15 which suits the eye implantation graft.
[Claim 17] Furthermore, medical equipment [equipped with an attachment means by which it is suitable in order to attach said electrode array in said user's retina tissue] according to claim 14.
[Claim 18] It is the medical equipment according to claim 17 with which said attachment means is equipped with at least one retina stop rivet located in said at least one mounting hole while said electrode array demarcates at least one mounting hole in it.
[Claim 19] Said attachment means is medical equipment [equipped with the retina stop rivet of the part of said scallop form respectively located inside] according to claim 17, including the outside-surface edge to which said electrode array demarcates the part of at least two scallop forms to inside.

[Claim 20] Said attachment means is medical equipment [equipped with the 2nd magnet suitable for being attached in the outside of the sclera of the user who counters the desirable point of attachment of said electrode array on said retina] according to claim 17, including 1st at least one magnet with which said electrode array was attached in it.
[Claim 21] Said attachment means is the medical equipment containing the adhesives arranged on the front face of said electrode array which should be attached in said retina according to claim 17.
[Claim 22] It is the approach of recovering partially at least the vision of the user troubled with the

degradation condition of the photoreceptor of an eye. Step which perceives a vision image, and answers said vision image, and generates a visual signal output, Step which carries out wireless transmission of said visual signal output at said eye, Step which stimulates said user's retina tissue according to said visual signal output, Said approach of including.
[Claim 23] Said step which perceives a vision image, and answers said vision image, and generates a visual signal output Step which changes a vision image into an electric impulse Step which samples said electric impulse corresponding to an image at the given time Step which encodes said selected image and enables the pixel-ized display of the image The approach according to claim 22 of including.
[Claim 24] Said step which carries out the wireless transmission of said visual signal output at said eye, The step which generates a radio-frequency carrier signal, The step which modulates said radio-frequency carrier signal and generates a radio-frequency modulation picture signal with said visual signal output, The step which transmits said radio-frequency modulation picture signal, Step which receives said radio-frequency modulation picture signal, Step which extracts said visual signal output from said radio-frequency carrier signal, The approach according to claim 22 of including.
[Claim 25] Said step which stimulates said user's retina tissue according to said visual signal output Step which decodes said visual signal output to two or more stimulus control signals of each Step which generates a stimulus current signal Step which impresses a stimulus to said retina tissue according to said stimulus current signal The approach according to claim 22 of including.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]
This invention relates to a medical-application eye device and an approach, and the approach of using the electrical-and-electric-equipment retina stimulus in an eye for the phosphene generation in an artificial-eye device, and it in more detail.
[0002]
[Description of the Prior Art]
When LeRoy let discharge of the Leyden jar pass in 1755 to the eye socket of the Homo sapiens who became blindness by the cataract, the patient looked at "the flame passed quickly downward." The fascination about vision by which induction was carried out electrically has taken place since then. In order to start the flash plate or phosphene of such a light, the general concept of carrying out electrical stimulation of the retinal cell is known remarkable in between. The electrode might be attached to a patient's head or eyelid into some attempts of the first stage about what the prosthetic appliance for helping visual disturbance based on these general principles is devised for. Although such an early attempt stored a success to which some were restricted, these initial prosthetic appliances could not be large, could not be bulky, and were not able to produce sufficient simulation eyesight to help a visually impaired person truly.
[0003]
However, while the operation technique in an eye progressed, it let the device transplanted into the eye itself pass, the stimulus concentrated by the small group and the retinal cell of further each was applied, and it became possible to produce the phosphene which doubled the focus. This aroused the new interest about developing the approach and equipment which help a visually impaired person. In the field of an eye entoretina prosthetic dentistry device, great efforts have been spent as an attempt to the equipment especially planted in the eye. This aroused the new interest about developing the approach and equipment which help a visually impaired person. Aiming at recovering vision in the case caused by photoreceptor denaturation nature retina disease like the macular degeneration relevant to aging from which loss of eyesight takes place to millions people in a retinitis pigmentosa or the world especially, great efforts have been spent in the field of an eye entoretina prosthetic dentistry device.
[0004]
One of such the devices is indicated by U.S. Pat. No. 4,628,933 which was given to Machelson as of December 16, 1986 and which is entitled "METHOD AND APPARATUS FOR VISUAL PROSTHESIS." The equipment of No. 933 of Michelson is connected to two or more electrodes located on the surface of the opposite side in order that this equipment may stimulate a retina including the array of photosensitive equipment on the front face. These electrodes are arranged so that an array similar to the "nail matrix" with the conductor who stimulates a retinal cell in a direct retina may be formed. The electric power supply of the device of No. 933 of Michelson is carried out by the separate circuit through electromagnetic induction or radio frequency induction. In order to receive this energy, the inductor which twisted around the perimeter of equipment or was formed on the surface of one side through the technique of a photograph monotonous circuit is contained in the device of No. 933 of Michelson. It is rectified, and the guided signal is filtered and carries out an

electric power supply to the electrode of an electrical circuit.
[0005]
[Problem(s) to be Solved by the Invention]
However, such a device raises the possibility of retina damage by use of the "nail-matrix" mold electrode which gives retina tissue a direct impact. Furthermore, there is the myopia or the longsighted problem by a photosensitive component being included.
[0006]
The device of No. 933 of Michelson is restricted by the physical size which can be used within an eye socket again. Since this cavity is small, and since equipment must be supported by the retina tissue itself, the amount of the image-processing circuit which can be included in it is restricted. Furthermore, the amount of an image-processing circuit is limited by the availability and use requirement of power within an eye socket. As a result of these restrictive factors, the device of No. 933 of Michelson fabricates an output wave on a charge balance square wave, and in order to adjust an electrical potential difference and the output of a current on the level permitted for neurone, it does not include image-processing circuits other than the common signal amplifier which only carries out the stroke of the response to the frequency-response bandwidth of retina neurone.
[0007]
[Means for Solving the Problem]
It is the purpose of this invention to conquer a part of known problem [at least] of these others in the advanced technology in view of the above. When furthermore specified, it is the purpose of this invention to offer the improved new artificial eye. It is the purpose of this invention that loss of eyesight offers especially the artificial eye which recovers vision partially at least in the case caused by the optical receptor degenerative disease. It is the further purpose of this invention to offer the level of the functional eyesight which improves a patient's maneuverability and makes reading possible. Furthermore, it is the purpose of this invention to offer such an artificial eye that can equip during an activity obligatory every day and is permitted aesthetic for a patient. Furthermore, it is the purpose of this invention to offer the approach of recovering eyesight.
[0008]
It is the description of the artificial eye of this invention to offer the component of both the inside of the eye for making into max the quality of the vision brought about by the artificial eye, and suppressing the effect on the retina caused in the light of these purposes, to the minimum and besides an eyeball. It is the further description of this invention to offer a means to transmit the visual signal of the perceived environment, without following physical contact in the meantime on the component in an eye from the component outside an eyeball. In addition, it is the description of this invention to extract power required for the component in an eye from a visual signal, without needing separate power signal transmission. Furthermore, it is the description of this invention to offer the artificial eye to which the electrode in an eye does not penetrate a retina.
[0009]
So, it is one side face of this invention to offer the artificial eye which has the image capture besides an eyeball and an encoding element, and a transmitting element based on radio frequency according to the above-mentioned purpose and the above-mentioned description. It is the further side face of this invention to offer the stimulating electrode in an eye on a retina front face. The radio frequency for receiving the visual signal which radio frequency transmits according to another side face of this invention is received, and the element which decodes and demultiplexes a sign is offered. The side face of the gestalt of one operation of this invention receives radio frequency, another side face of the gestalt of another operation receives radio frequency including offering the element in an eye which decodes and demultiplexes a sign, and it includes offering the element outside an eyeball which decodes and demultiplexes a sign.
[0010]
The gestalt of one operation of the artificial eye of this invention includes the encoder circuit for encoding so that the image sampling circuit for choosing an image at the camera for changing ****** into electrical stimulation and the given time and the selected image may be indicated by the pixel. Next, the signal corresponding to the selected image is used, and a radio frequency carrier signal is modulated so that it can transmit into an eye by the tuning coil pair with the primary

secondary coil.
[0011]
The demodulator circuit is connected with the secondary coil for extracting the visual signal output from a radio frequency carrier signal. The decoder is connected with the demodulator which decodes a visual signal output to two or more stimulus control signals of each, and the demodulator is connected with the current generation circuit which answers and generates a stimulus current signal. An electrode array has two or more electrodes operationally connected with the current generation circuit means. An electrode answers each stimulus control signals of these, and stimulates retina tissue.
[0012]
The method of making the user suffered from the optical receptor denaturation retina condition of an eye recover vision in part at least perceives :a vision image containing the following step, and stimulates a user's retina tissue according to; and c visual signal output which carry out wireless transmission of the;b visual signal output which answers it and generates a visual signal output into an eye.
[0013]
The purpose and advantage of these others of this invention will become clearer from the following detailed explanation, referring to an attached drawing.
[0014]
Although various corrections and an alternative structure are possible for this invention, it shows the gestalt of a part of the instantiation-operations to a drawing, and explains it in full detail below. However, as for limiting to the specific gestalt which is having this invention indicated, it is clear that it is not meant but this invention includes conversely the pneuma of this invention defined by the attached claim, all corrections included in within the limits and an alternative structure, an approach, and an equal object.
[0015]
[Embodiment of the Invention]
As stated briefly in the top, the equipment by this invention is medical equipment which recovers eyesight partially at least, when it becomes blindness according to photoreceptor deterioration retina diseases with which millions of persons are risked all over the world, such as a retinitis pigmentosa and quality of an age relevance spots status change. The intention of partial recovery of this eyesight is improving migratory [of a patient], and enabling it to read large printed matter at least, and making independent consciousness increase by this. If it says briefly, vision will be attained by changing into the electric pulse of 1 ream mapped on a retina by stimulating electrically the nerve cell which is in the other side of malfunction photoreceptor about the image of the scene before a patient's eye and which is functioning. Therefore, the purpose of this invention is to offer the level of the functional vision of a under [an acceptable package] aesthetic for a patient that it can wear at the time of an everyday activity. The whole system by this invention is included in the pocket-type body wear package which functions without using an embedded dc-battery and the invasion connector in an eye. a part for the interior of an eye of the artificial eye by this invention -- the standard ophthalmic surgery operation technique -- using -- the inside of a patient's inside of an eye -- embedded ****** -- it is designed like.
[0016]
Therefore, speaking concretely, the artificial eye by the gestalt of the desirable operation with this invention having perceived the visible image, and equipping it with a means to generate a visual signal output in response to it, the retina tissue stimulus means attached in a user's retina possible [actuation], and the wireless visual signal means of communications which transmits this visual signal output to this retina tissue stimulus means. As for this means to perceive a visible image, it is desirable to have a camera means to change a visible image into an electric impulse, an image sampling means to be connected with this camera means and to choose an image at the time of arbitration, and an encoder means to be connected with this image sampling means and to encode the selected image, and to pixel-ize it and to display it.
[0017]
in addition, with the gestalt of the desirable operation with this invention A decoder means by which

the above-mentioned retina tissue stimulus means decrypts this visual signal output to two or more individual stimulus control signals in response to a visual signal output, It has the electrode array which has two or more electrodes which are connected with this decoder means and connected with a current generating circuit means to generate a stimulus current signal, and this current generating circuit means, possible [actuation] in response to two or more aforementioned individual stimulus control signals. These electrodes generate sufficient stimulus pulse to stimulate retina tissue in response to the aforementioned individual stimulus control signal.

[0018]

Furthermore, with the gestalt of the desirable operation with this invention, this electrode array equips a user's retina with an attachment means to attach this electrode array, further. With the gestalt of a certain operation, this electrode array demarcated at least one mounting hole in it, and the above-mentioned attachment means is equipped with at least one retina stop rivet located in this at least one mounting hole. In the alternative example, this electrode array contains the outside-surface edge which demarcates at least two scallop form parts to the inside of it, and the above-mentioned attachment means is equipped with the retina stop rivet located in each interior of this scallop form part. With the gestalt of the further alternative implementation, this electrode array contains at least one magnet attached in self, and the attachment means is equipped with the 2nd magnet attached in the outside of the sclera of the user in the opposite side of the desired attachment point of the electrode array on a retina. With the gestalt of still more nearly another operation, the above-mentioned attachment means contains the adhesives placed on the front face of the aforementioned electrode attached in a retina.

[0019]

With the gestalt of the further operation of this invention, wireless visual signal means of communications is equipped with a carrier generating means to generate a radio frequency carrier signal, and a modulation means to generate the picture signal by which modulated this radio frequency carrier signal with this visual signal output, and the radio frequency modulation was carried out in response to the radio frequency carrier signal and the visual signal output. In addition, the gestalt of this operation contains the tuning coil pair which has a primary coil and a secondary coil. This primary coil is connected with a modulation means possible [actuation], and transmits a radio frequency modulation picture signal. The secondary coil is being aligned so that a radio frequency modulation picture signal may be received. The recovery means is connected with the secondary coil and a visual signal output is extracted from a radio frequency carrier signal.

[0020]

The gestalt of the desirable operation with this invention was connected with the secondary coil, and is further equipped with a power-source means to supply power to a retina tissue stimulus means and a recovery means. As for this, it is desirable to perform by extracting energy from a radio frequency modulation picture signal. This power means rectifies a radio frequency carrier signal based on the radio frequency modulation picture signal which the aforementioned secondary coil received, generates direct current power, and supplies it to a retina tissue stimulus means and a recovery means.

[0021]

Therefore, the desirable approach of existing of recovering partially the eyesight of a user with the photoreceptor deterioration retina condition of an eye at least perceives a visible image, and contains the step which generates a visual signal output in response to it, the step which carries out wireless transmission of the visual signal output into an eye, and the step which stimulates a user's retina tissue according to the visual signal output. As for the step of the above which perceives a visible image and generates a visual signal output in response to it, it is desirable to include the step which changes a visible image into an electric impulse, the step which samples this electric impulse corresponding to the image at the time of arbitration, and the step which encodes the selected image, pixel-izes it and displays it.

[0022]

In addition, as for the aforementioned step which carries out the wireless transmission of the visual signal output into an eye, it is desirable to be included the step which generates a radio-frequency carrier signal, the step which modulates this radio-frequency carrier signal with a visual signal

output, and generates a radio-frequency modulation picture signal, the step which transmits a radio-frequency modulation picture signal, the step which receives a radio-frequency modulation picture signal, and the step which extracts a visual signal output from a radio-frequency carrier signal. Moreover, with the gestalt of a certain desirable operation, the aforementioned step which stimulates a user's retina tissue according to a visual signal output contains the step which decrypts a visual signal output to the stimulus control signal according to two or more individuals, the step which generates a stimulus current signal, and the step which gives retina tissue a stimulus according to a stimulus current signal.

[0023]

With the gestalt of the instantiation-operation which has above-mentioned this invention shown with the block diagram in drawing 1 , the retina prosthetic appliance 10 and the artificial-eye device currently illustrated contain image capture components, such as the standard charge-coupled-device (CCD) camera 12 which generates the visual signal output under circuit block 14 processed and encoded. Next, this picture signal processed and encoded is transmitted as a radio frequency encoding picture signal through the primary coil 16. The secondary coil 18 receives a radio frequency encoding picture signal, and sends it out to a decryption / demulti pre KUSHINGU circuit block 20. Next, this circuit block 20 communicates the decrypted picture signal to the electrode array 22, the electrode array 22 stimulates a retinal cell, and generates the phosphene and stimulates vision.

[0024]

The chain line 24 of drawing 1 is indicated in order to separate image acquisition / transmitting part 26 of the vision retina prosthetic appliance 10 from image reception / stimulus part 28, and it should be noticed about separating the field outside an eye from the field in an eye so that it may explain in full detail below with reference to 6 from drawing 4 not being shown or shown. Moreover, although these drawings show the place which is using the CCD camera, it should be cautious of the range of this invention being what is not restricted to it and includes the technique of image acquisition equipments, such as a video camera, a digital camera, and a CMOS camera.

[0025]

Image acquisition / transmitting part 26 of the artificial eye by this invention is illustrated by drawing 2 at the detail, and mentions below. The picture signal captured with the camera 12 is outputted to the image sampling circuit 30, and this sampled image is sent out to the pixel encoder 32 so that it may be observed from this drawing. If this sampled picture signal is encoded correctly, it will be sent to the signal modulator 34, and this signal modulator 34 modulates the radio frequency carrier signal which the carrier generator 36 generated using this. This radio frequency modulation picture signal is transmitted through the primary coil 16 next.

[0026]

An encoding scheme is optimized so that it may explain in full detail below, and whenever [solution image / of the image made into the target decided by size of the embedded electrode array] may be obtained. In order to stimulate the amplitude, timing, and a retina and to simulate an image, parameters, such as a sequence of the stimulus pulse generated by the array, are contained in the encoded information. Modulation technique is maximized covering the transmitting path which it has [path] consistency with the data rate and has the fidelity of the restored information meant.

[0027]

A radio frequency modulation picture signal is received by image reception / stimulus part 28 of an artificial eye so that it may illustrate in detail to drawing 3 . If this signal is received by the secondary coil 18, it will be sent out to a demodulator 38 and a carrier signal will be removed from a decryption picture signal here. Next, it is sent out to a decoder / demultiplexer 40, image information is outputted to the current generator 42 from here, and the electrode according to individual of the electrode array 22 drives a decryption picture signal. The power for this image reception / stimulus part 28 of an artificial eye is drawn out by the rectifier 44 from the energy included by the carrier signal. It is rectified, this carrier signal is flowing in one direction, power is supplied to the embedded electronic equipment, and a stimulus pulse is generated. Therefore, another power sending signal is unnecessary.

[0028]

Image reception / stimulus part 28 of an artificial eye restores to it and decrypts stimulus information, and the suitable stimulus pulse transmitted to the electrode array 22 embedded at the retina is generated. By decryption transmission, it determines where [of the electrode array 22] this pulse is impressed as the description of a stimulus pulse. This pulse is transmitted by other suitable means, such as the small ribbon cable 46 in the cavity in an eye, or a fiber optic cable.
[0029]
The gestalt of one operation is shown in drawing 4 R> 4 for which the artificial eye by this invention is transplanted physically and which is referred to here. As mentioned above, a radio frequency encoding picture signal is transmitted to the secondary coil 18 using the primary coil 16. As for this primary coil, it is desirable to place into an eyeball lens, a frame, or a soft contact lens. With the gestalt of this operation, induction connection of the radio frequency sign picture signal is carried out at the secondary coil 18 to which it is transplanted behind the iris 48 using this coil 16. This secondary coil 18 is connected with a decryption / demulti pre KUSHINGU circuit 20, and is put on the same location as this. The small ribbon cable 46 is positioned in accordance with the wall of an eye, and connects a circuit 20 with the electrode array 22 located on the about 52-eye socket retina 50. As an alternative example, although a circuit 20 can be united with the electrode array 22, the small wire which has come out of the secondary coil 16 in this case is only needed in order to connect a visual signal with the compost (not shown) of a circuit and an array. The detail of the attachment mechanism which fixes the electrode array 22 to a retina 50 is explained in full detail below with reference to 10 from drawing 8 .
[0030]
With the gestalt of the alternative implementation with this invention shown in drawing 5 , although the decryption / demulti pre KUSHINGU circuit 20 is not established in homotopic in the secondary coil 18 in the back of the iris 48 instead, it is attached in the outside of sclera 54. This attachment is based on a suture or other suitable means. With the gestalt of this operation, a decryption / demulti pre KUSHINGU circuit 20 is placed into the package by which airtight sealing was carried out, and is connected with the secondary coil with the small wire 56 which penetrates sclera 54. The small ribbon cable 46 which has connected the decryption / demulti pre KUSHINGU circuit 20 with the electrode array 22 in which it is attached by the retina 50 has also penetrated sclera 54.
[0031]
With the gestalt of the further alternative implementation of this invention, it is attached in sclera 54 instead of a secondary coil being transplanted in an eye, as shown in drawing 6 . The attachment to the sclera 54 of the secondary coil 18 is based on a suture or other suitable means like [in the case of a decryption / demulti pre KUSHINGU circuit 20]. Therefore, in order to penetrate sclera 54, the small ribbon cable which attaches a decryption / demulti pre KUSHINGU circuit 20 in the electrode array 22 attached in the retina 50 is only needed. By attaching a decryption / demulti pre KUSHINGU circuit 20 out of an eye, access to this circuit increases and the exchange and updating of these component parts become easy by this.
[0032]
As mentioned above, the electrode array 22 shown in drawing 7 with schematic drawing is a living thing adaptation device attached on the front face of a retina near the eye socket. This array 22 is only a passive element which transmits the charge in a stimulus pulse to retina tissue, or is the active network which can control selection of the stimulus part in the case of that input using the encoded information. Spacing is opened so that the stimulus part 58 in an array may give the capacity of the patient who identifies activation of the adjoining part, and the adjusted eyesight level. The stimulus part 58 consists of the ingredient designed so that transmission of an electrode and the charge during a surrounding organization might be maximized. Although the array 22 shown in drawing 7 has only the stimulus part array of 5x5, this numeric value may be fluctuated. When the size increases, as for an array 22, it is desirable that it is flexible so that surface contact to all the suitable fields of a retina may be attained. May 5, 1992 which the electrode array 22 by this invention and a certain suiting electrode design use with reference to the instruction and contents of an indication here and which is entitled "RETINAL MICROSTIMULATION" -- attaching -- coming out -- de Juan It is indicated by U.S. Pat. No. 5,109,844 given to Jr and others.
[0033]

The attachment to the retina front face of an electrode array is attained by the suitable approach. With the gestalt of one certain operation, the stop rivet made from titanium generally used in order to support, in case it holds to a choroid, the mechanical fixed device, for example, the intercept which the retina separated, shown in drawing 8 , is used. The stop rivet 60 holds an array in an original location by letting the inside of the circular hole 62 on each angle of the body of an array 22 pass, and penetrating a retina, a choroid, and sclera. As an alternative of the stop rivet 60, a suture also functions as a mechanical fixed device.

[0034]

With the gestalt of a certain alternative implementation, as shown in drawing 9 , it stops in the scallop form part currently illustrated as a hemicycle notch 54 of each angle of an array 22, a rivet 60 is positioned, and an array 22 is fixed to a retina by holding the array itself according to the compressive force of the array 22 produced as a result in an original location. Since the stop rivet 60 does not invade into an array body, this means of attachment have the advantage that exchange is easy.

[0035]

The alternate method which is not intrusive is shown in the gestalt of alternative implementation of drawing 10 rather than it attaches an array 22 in a retina. The gestalt of this operation uses the inactive small rare earth magnet 66 embedded by each angle of the silicone array 22 during casting. The magnet (not shown) which accomplishes the 2nd set is immediately sutured from the location of a request of an array 22 on the outside of the eye of an opposite side. The magnetism between the magnet 66 in an eye in an array 22 and the magnet sutured on the outside of an eye serves to hold an array 22 in an original location. This approach cancels the need of penetrating **** with a stop rivet, and makes exchange of an array easier now.

[0036]

With the gestalt of the alternative implementation with this invention, an array is fixed to a retina using the adhesives permitted medically, for example, cyanoacrylate and other suitable adhesives. With the gestalt of this operation, these adhesives are applied to the edge of an array, before an array is finally positioned at a retina. Then, a temporary air pocket is generated in a vitreous body, and adhesives are stiffened.

[0037]

The ingredient used with the gestalt of the desirable operation with the artificial eye by this invention with the component part which is the one section of the retina implant is the same as the ingredient used for the present-day cochlea implant. However, since there are other probably more good and more suitable ingredients proved by the eye implantation graft, such an ingredient specified should be noticed about it not being what restricts the range of this invention. As for the package of the electronic equipment transplanted with the gestalt of a certain desirable operation, it is desirable that it is titanium covered with silicone. A secondary coil is a product made from platinum, and embedding into silicone is desirable. As for an electrode array, with the gestalt of this operation, it is desirable to consist of the wire made from platinum in a silicone matrix. Also in case use within an eye is approved by FDA and all of these ingredients are used by such artificial eye, they show the suitable electric description biological again.

[0038]

The gestalt of many corrections and modification implementation to this invention is clear to this contractor from the aforementioned explanation. Therefore, this explanation should be interpreted as the purpose which teaches the best gestalt which does not pass for the purpose of instantiation and carries out this invention to this contractor. Being able to change the structure and the detail of a configuration, without deviating from the pneuma of this invention substantially, and using exclusively all the examples of correction of this invention within the limits is reserved.

[Brief Description of the Drawings]

[Drawing 1]

It is the outline block graph according to the gestalt of operation of this invention which the artificial eye simplified.

[Drawing 2]

They are vision acquisition of the gestalt of operation of the artificial eye of this invention, encoding,

and the expansion outline block graph of a radio frequency transmitting component.

[Drawing 3]

They are acceptance of the radio frequency visual signal of the gestalt of operation of the artificial eye of this invention, decode, and the expansion outline block graph of a retina stimulus component.

[Drawing 4]

It is the cross-sectional view which the gestalt of operation of the artificial eye of this invention when transplanting in an eye simplified.

[Drawing 5]

It is the cross-sectional view which the gestalt of the alternative-like operation of the artificial eye of this invention when transplanting in an eye simplified.

[Drawing 6]

It is the cross-sectional view which the gestalt of the further alternative-like operation of the artificial eye of this invention when transplanting in an eye simplified.

[Drawing 7]

It is the schematic diagram which the stimulating electrode array in an eye according to one side face of the gestalt of operation of the artificial eye of this invention simplified.

[Drawing 8]

It is the partial schematic diagram of the cross section of the stimulating electrode array in an eye which illustrates the detail of the add-on of the stimulating electrode array in an eye according to one side face of the gestalt of operation of the artificial eye of this invention.

[Drawing 9]

It is the partial schematic diagram of the cross section of the stimulating electrode array in an eye which illustrates the detail of the add-on of the stimulating electrode array in an eye according to one side face of the gestalt of the alternative-like operation of the artificial eye of this invention.

[Drawing 10]

It is the partial schematic diagram of the cross section of the stimulating electrode array in an eye which illustrates the detail of the add-on of the stimulating electrode array in an eye according to one side face of the gestalt of the further alternative-like operation of the artificial eye of this invention.

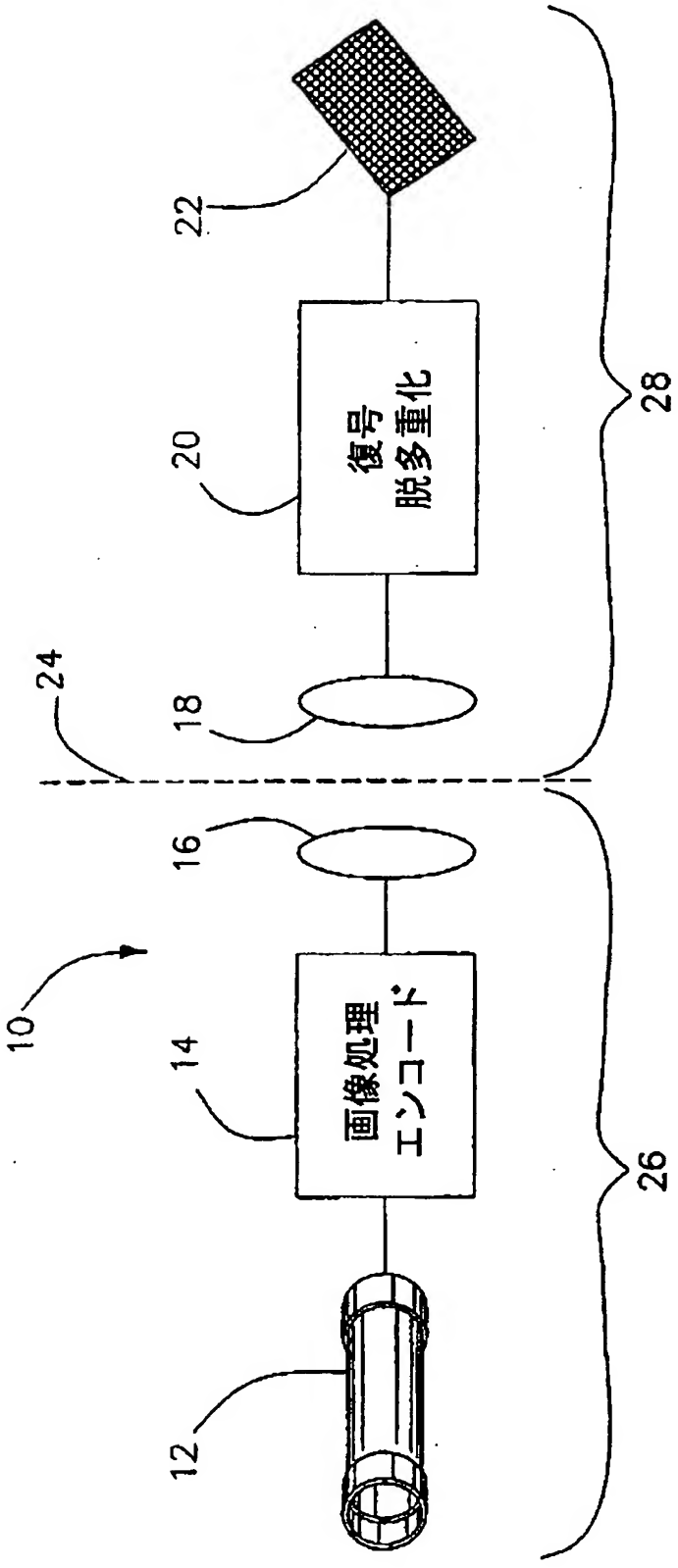
[Translation done.]

* NOTICES *

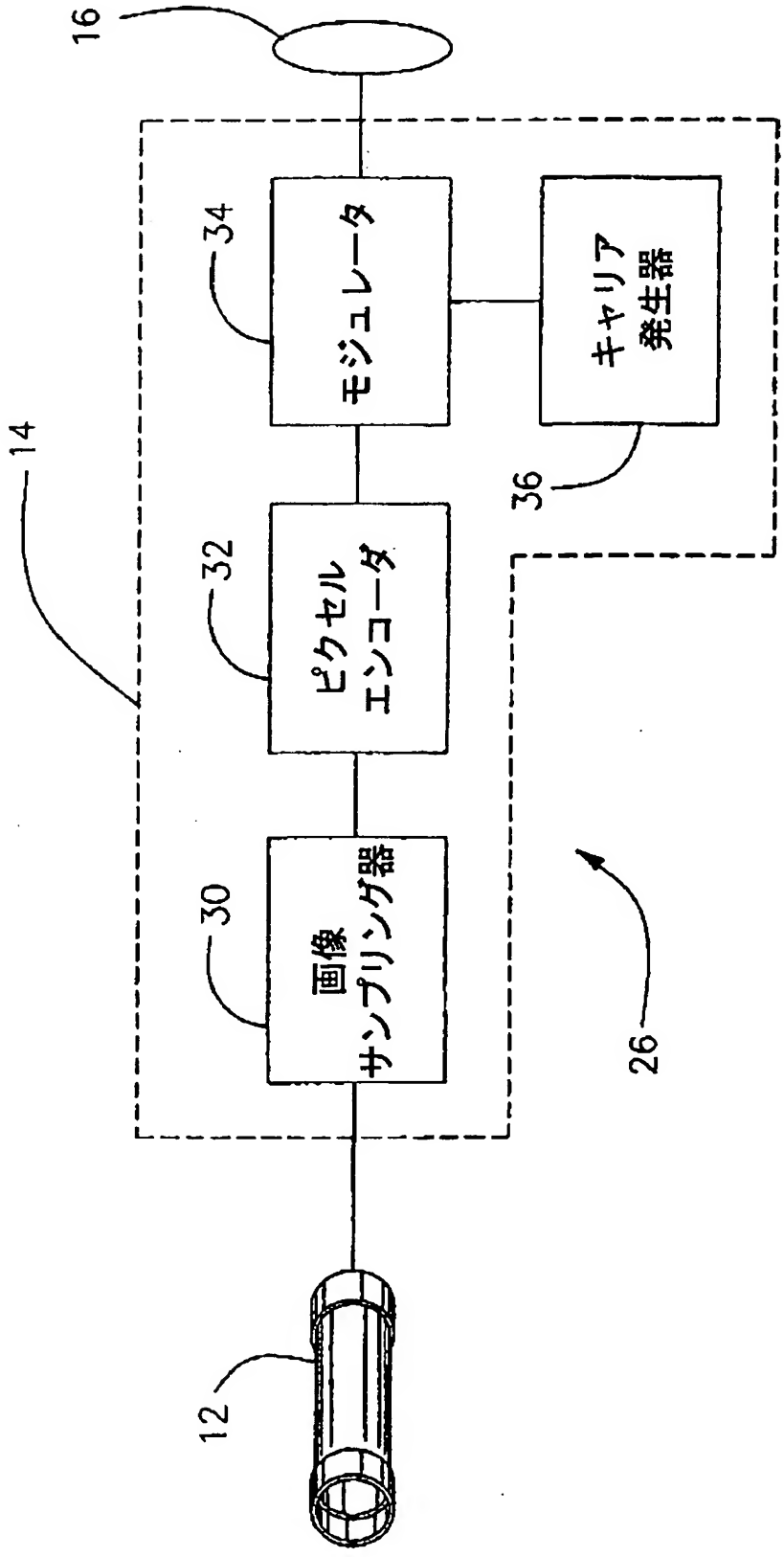
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

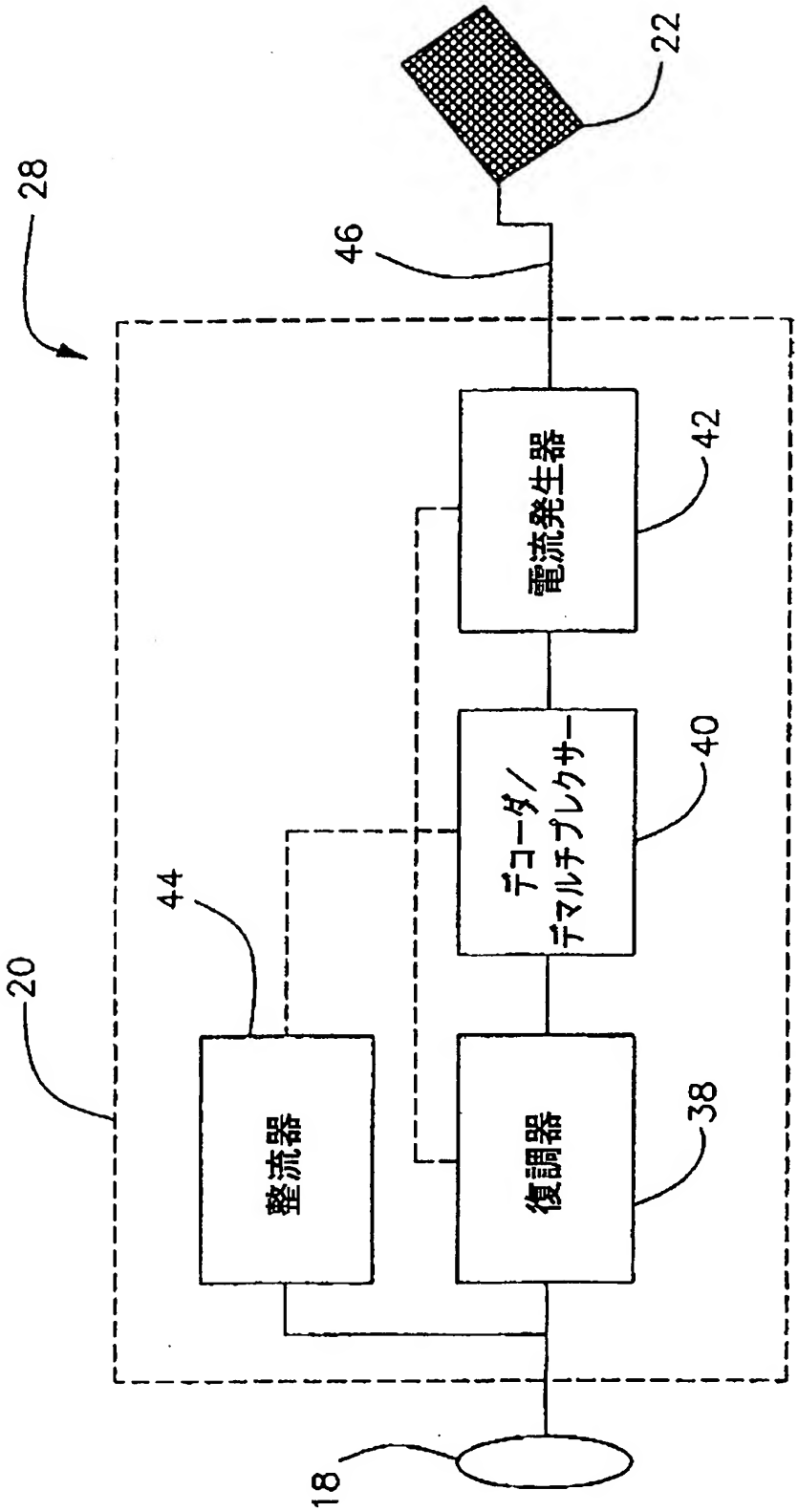
[Drawing 1]



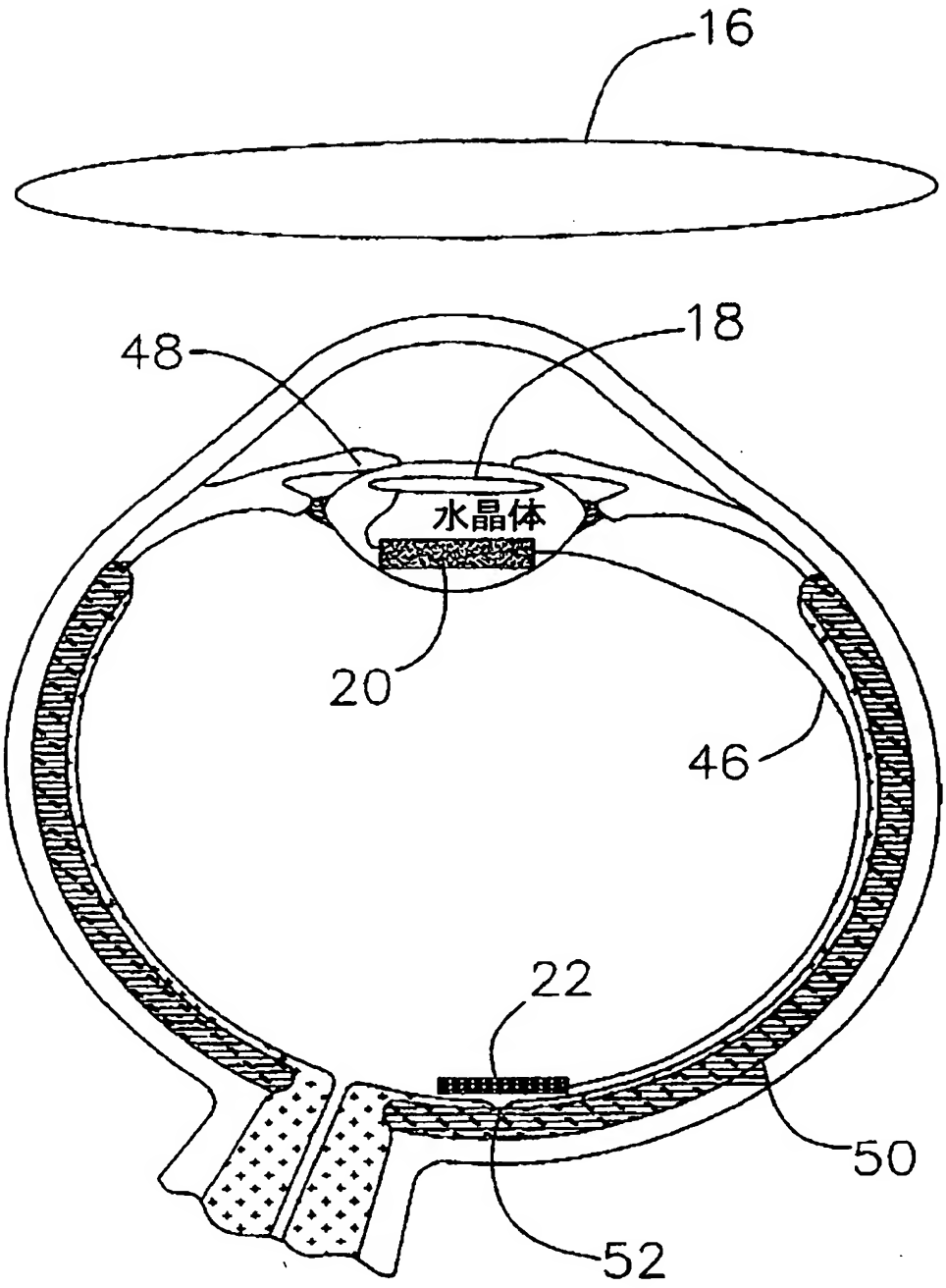
[Drawing 2]



[Drawing 3]



[Drawing 4]



[Drawing 5]

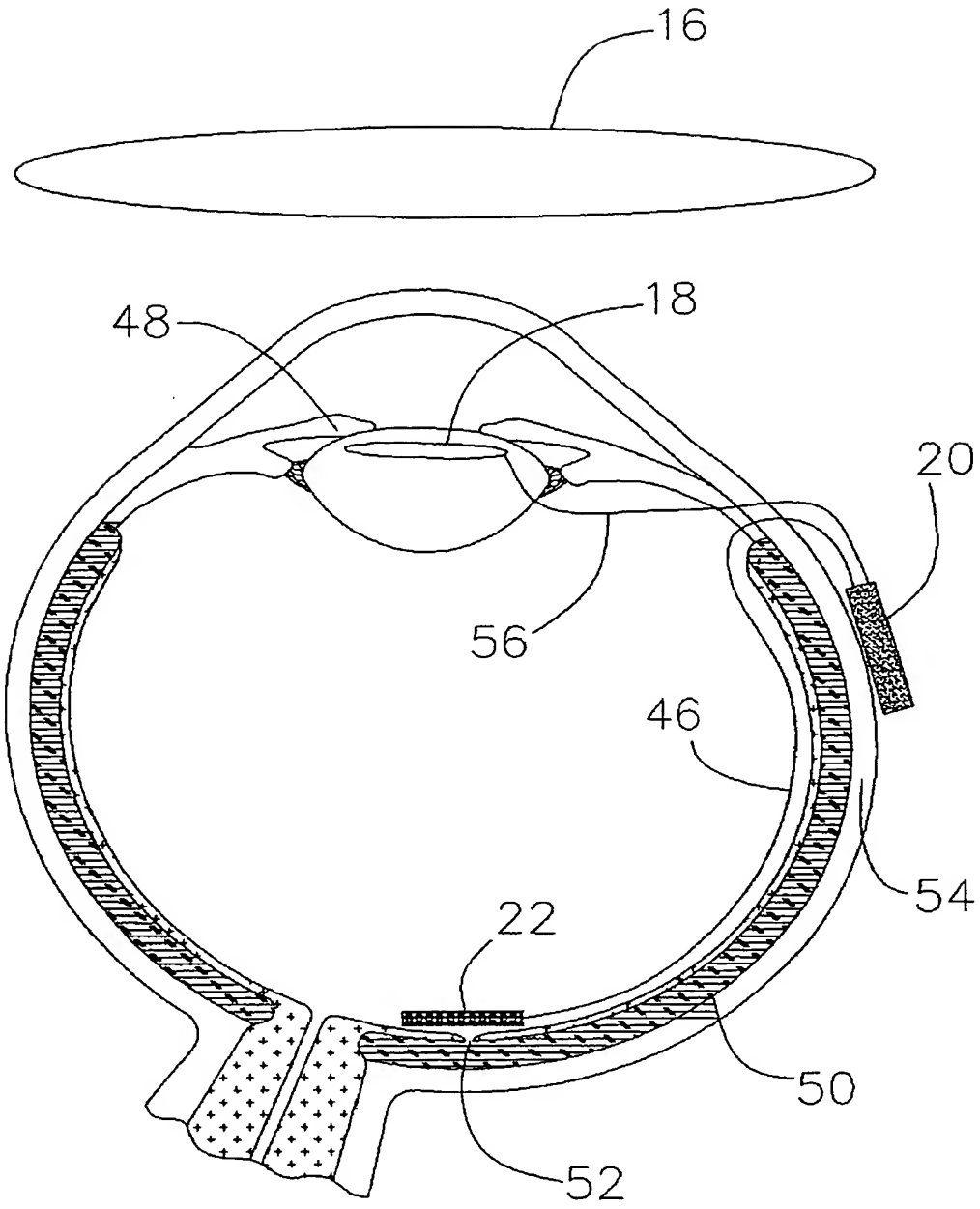


Fig. 5

[Drawing 6]

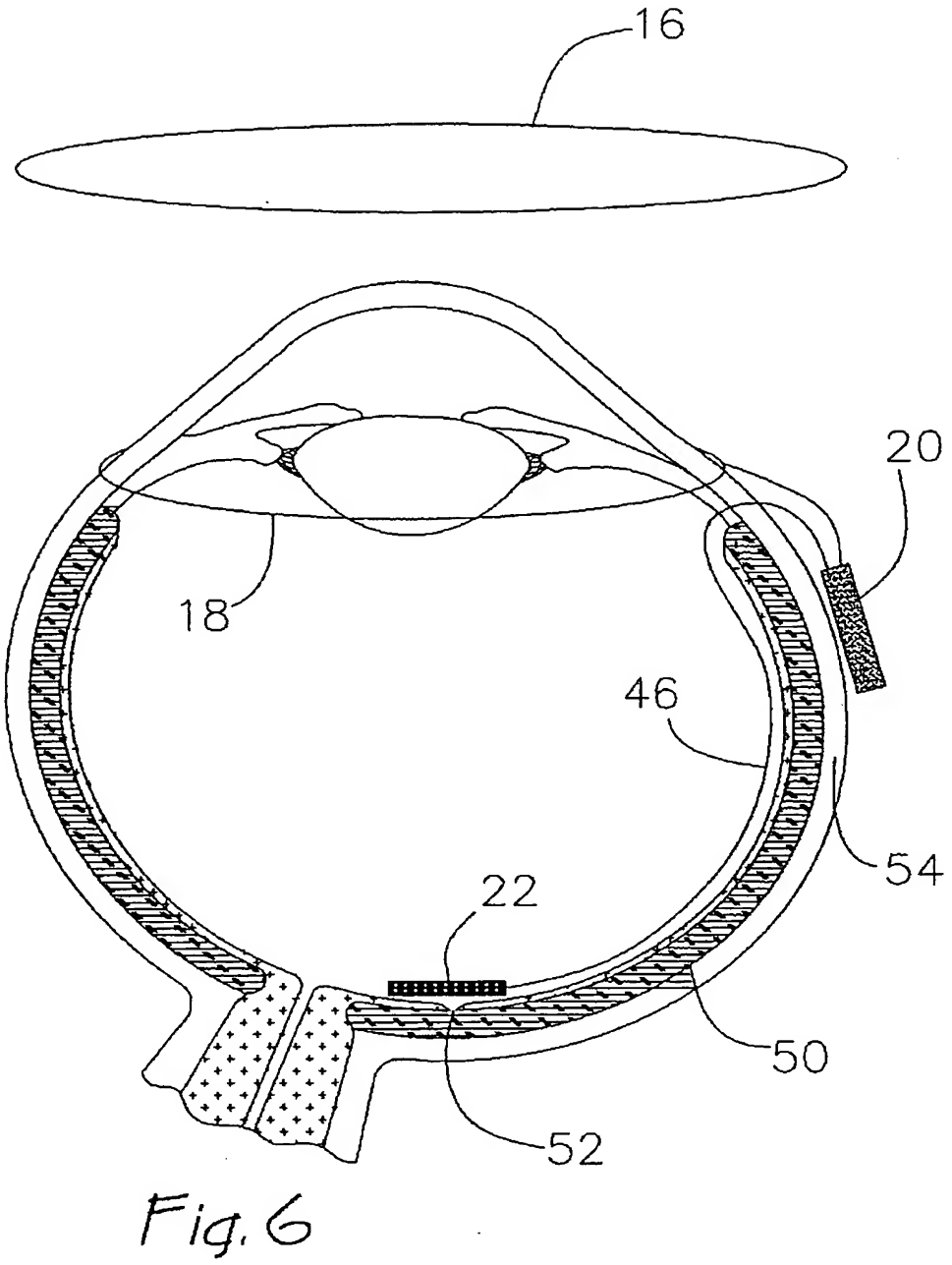


Fig. 6

[Drawing 7]

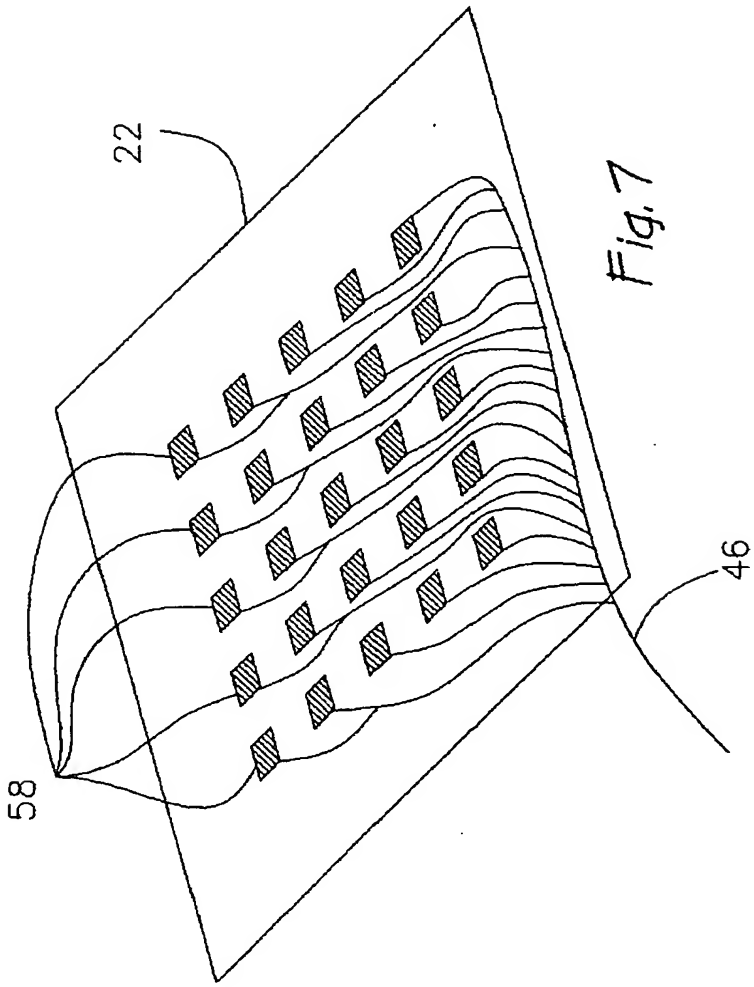


Fig. 7

[Drawing 8]

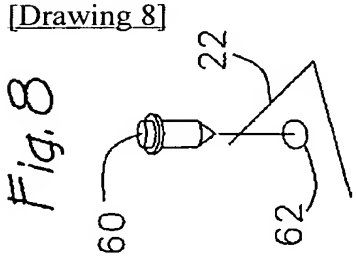


Fig. 8

[Drawing 9]

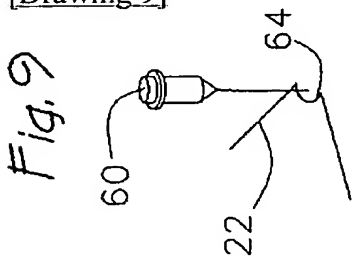


Fig. 9

[Drawing 10]

Fig. 10

[Translation done.]